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CLAIMS:

10 1. A software system for constrained graphs, the system implemented in accordance with an object-oriented design framework, wherein said graph is constructed using a plurality of graphical elements, the system comprising:

a plurality of subgraph classes, wherein an instance of each of said subgraph classes comprises a predefined grouping of one or more of said graphical elements representative of a subgraph type; and

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each of said plurality of subgraph classes adapted to:

reposition the graphical elements of a subgraph within said graph, said subgraph represented by an instance of one of said plurality of subgraph classes; and

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initiate a repositioning of the graphical elements of subgraphs affected by said repositioning of the graphical elements of the subgraph represented by said instance of said one of said plurality of subgraph classes.

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2. The software system of claim 1, wherein each of said plurality of subgraph classes is further adapted to:

display the graphical elements of a subgraph represented by said instance of said one of said plurality of subgraph classes to a user in a specified layout format.

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3. The software system of claim 2, wherein said specified layout format comprises a layout selected from the following group: a horizontal layout and a vertical layout.

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5 4. The software system of claim 2, wherein said specified layout comprises a directional layout.

10 5. The software system of claim 1, further comprising a first subgraph class wherein said first subgraph class is extended to define said plurality of subgraph classes.

15 6. The software system of claim 5, wherein said first subgraph class comprises an abstract class.

20 7. The software system of claim 1, further comprising:

 a layout manager adapted to:

 initiate the repositioning and display of the graphical elements of a plurality of subgraphs in said graph by commanding the repositioning and display of the graphical elements of a selected subgraph in said graph.

25 8. The software system of claim 7 wherein said layout manager is further adapted to:

 identify a plurality of subgraphs in said graph;

 receive an identifier of an input subgraph in said graph;

 determine from said identifier a selected subgraph to be shifted; and

30 command said selected subgraph to reposition and display the graphical elements.

- 5 9. The software system of claim 8 further comprising
- a first layout manager class which can be extended to define one or more second
 layout manager classes; and
- 10 wherein said layout manager comprises an instance of a second layout manager
 class.
- 15 10. The software system of claim 8, wherein the selected subgraph determined from
 said identifier comprises said input subgraph.
11. The software system of claim 9, wherein said instance of a second layout
 manager class is created when one or more graphical elements are added to or deleted
 from said graph.
- 20 12. The software system of claim 11, further comprising a module for obtaining input
 from a user, wherein a request to add or delete graphical elements from said graph is
 generated from said input.
13. The software system of claim 8, wherein data associated with subgraphs
25 identified by an instance of said second layout manager class is stored in a map, and
 wherein said map is used by instances of said second subgraph classes in determining
 affected subgraphs.
14. The software system of claim 13, wherein said map comprises a hash map.
- 30 15. The software system of claim 1, wherein said repositioning of the graphical
 elements of said specific subgraph requires that said graphical elements be shifted
 either horizontally or vertically in said graph.

5 16. The software system of claim 2, wherein said specified layout comprises a directional layout.

17. The software system of claim 1, wherein a subgraph comprises a further subgraph.

10 18. The software system of claim 1, wherein each of said plurality of second subgraph classes is further adapted to determine data properties for instances thereof, the data properties selected from the following group: height of subgraph, width of subgraph, location of subgraph on a display device, connections going into a subgraph,
15 and connections going out of a subgraph.

19. A software system for use in the design of software applications in which a constrained graph is displayed, the system implemented in accordance with an object-oriented design framework, wherein said graph is constructed using a plurality of
20 graphical elements, the system comprising:

a first subgraph class, wherein said first subgraph class can be extended to define a plurality of second subgraph classes, wherein an instance of each of said second subgraph classes represents a subgraph of a specific subgraph type, wherein each subgraph of a specific subgraph type is composed of a predefined grouping of one or more of said graphical elements, and wherein each of said plurality of second subgraph classes implements one or more first methods for

25 repositioning the graphical elements of a subgraph represented by an instance thereof within said graph and determining affected subgraphs,

30 displaying the graphical elements of a subgraph represented by an instance thereof to said user in a specified layout format, and commanding a repositioning and display of the graphical elements of said affected subgraphs.
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20. The software system of claim 19, further comprising a first layout manager class, wherein said first layout manager class can be extended to define one or more second layout manager classes, wherein an instance of each of said second layout manager classes represents a layout manager, wherein each of said second layout manager classes implements one or more second methods for

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identifying a plurality of subgraphs in said graph,
receiving an identifier of an input subgraph in said graph,
determining from said identifier a selected subgraph to be shifted,
and

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commanding a repositioning and display of the graphical elements of
said selected subgraph by calling the one or more first methods
implemented by the second subgraph class of which said selected
subgraph is an instance;

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such that when an instance of a second layout manager class is created, said one or more second methods are executed, whereby the layout manager represented by said instance identifies a plurality of subgraphs in said graph and initiates the repositioning and display of the graphical elements of a plurality of subgraphs in said graph by commanding the repositioning and display of the graphical elements of a selected subgraph in said graph.

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21. The system as claimed in claim 19, wherein said first subgraph class is an abstract class.

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22. The system as claimed in claim 20, wherein the selected subgraph determined from said identifier is said input subgraph.

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23. The system as claimed in claim 19, wherein said instance of a second layout manager class is created when one or more graphical elements are added to or deleted from said graph.

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24. The system as claimed in claim 23, further comprising a module for obtaining input from a user, wherein a request to add or delete graphical elements from said graph is generated from said input.

10 25. The system as claimed in claim 19, wherein data associated with subgraphs identified by an instance of said second layout manager class is stored in a map, and wherein said map is used by instances of said second subgraph classes in determining affected subgraphs.

15 26. A computer readable media storing data and instructions, said data and instructions when executed by a computing device adapt said computing device to:

20 organize a plurality of subgraph classes, wherein an instance of each of said subgraph classes comprises a predefined grouping of one or more of said graphical elements representative of a subgraph type; and

each of said plurality of subgraph classes adapted to:

25 reposition the graphical elements of a subgraph within said graph, said subgraph represented by an instance of one of said plurality of subgraph classes; and

30 initiate a repositioning of the graphical elements of subgraphs affected by said repositioning of the graphical elements of the subgraph represented by said instance of said one of said plurality of subgraph classes.

5 27. The computer readable media of claim 26, wherein each of said plurality of subgraph classes is further adapted to:

10 display the graphical elements of a subgraph represented by said instance of said one of said plurality of subgraph classes to a user in a specified layout format.

15 28. The computer readable media of claim 26, wherein said specified layout format comprises a layout selected from the following group: a horizontal layout and a vertical layout.

20 29. The computer readable media of claim 26, wherein said specified layout comprises a directional layout.

25 30. The computer readable media of claim 26, further adapting said computer device to organize a first subgraph class wherein said first subgraph class is extended to define said plurality of subgraph classes.

30 31. The computer readable media of claim 30, wherein said first subgraph class comprises an abstract class.

35 32. The computer readable media of claim 26, further adapting said computer device to:

 organize a layout manager adapted to:

40 initiate the repositioning and display of the graphical elements of a plurality of subgraphs in said graph by commanding the repositioning and display of the graphical elements of a selected subgraph in said graph.

5 33. The computer readable media of claim 32 wherein said layout manager is further adapted to:

 identify a plurality of subgraphs in said graph;

 receive an identifier of an input subgraph in said graph;

10 determine from said identifier a selected subgraph to be shifted; and

 command said selected subgraph to reposition and display the graphical elements.

15 34. The computer readable media of claim 8 further adapting said computer device to:

20 organize a first layout manager class which can be extended to define one or more second layout manager classes; and

 wherein said layout manager comprises an instance of a second layout manager class.

25 35. The computer readable media of claim 33, wherein the selected subgraph determined from said identifier comprises said input subgraph.

30 36. The computer readable media of claim 32, wherein said instance of a second layout manager class is created when one or more graphical elements are added to or deleted from said graph.

37. The computer readable media of claim 36, further adapting said computer device to organize a module for obtaining input from a user, wherein a request to add or delete graphical elements from said graph is generated from said input.

5 38. The computer readable media of claim 33, wherein data associated with subgraphs identified by an instance of said second layout manager class is stored in a map, and wherein said map is used by instances of said second subgraph classes in determining affected subgraphs.

10 39. The computer readable media of claim 32, wherein said map comprises a hash map.

15 40. The computer readable media of claim 26, wherein said repositioning of the graphical elements of said specific subgraph requires that said graphical elements be shifted either horizontally or vertically in said graph.

41. The computer readable media of claim 26, wherein said specified layout comprises a directional layout.

20 42. The computer readable media claim 26, wherein a subgraph comprises a further subgraph.

25 43. A layout manager defined by a layout manager interface, said layout manager interface provided by a software system for use in the design of software applications in which a constrained graph is displayed to a user, the system implemented in accordance with an object-oriented design framework, wherein said graph is constructed using a plurality of graphical elements, the system comprising:

30 a first subgraph class, wherein said first subgraph class can be extended to define a plurality of second subgraph classes, wherein an instance of each of said second subgraph classes represents a subgraph of a specific subgraph type, wherein each subgraph of a specific subgraph type is composed of a predefined grouping of one or more of said graphical elements, and wherein each of said plurality of second subgraph classes implements one or more

35 first methods for

5 repositioning the graphical elements of a subgraph represented by an
instance thereof within said graph and determining affected subgraphs,
displaying the graphical elements of a subgraph represented by an
instance thereof to said user in a specified layout format, and
commanding a repositioning and display of the graphical elements of said
10 affected subgraphs; and

a first layout manager class interface, wherein said first layout manager class
can be extended to define one or more second layout manager classes,
wherein an instance of each of said second layout manager classes
represents a layout manager, wherein each of said second layout manager
15 classes implements one or more second methods for

identifying a plurality of subgraphs in said graph,
receiving an identifier of an input subgraph in said graph,
determining from said identifier a selected subgraph to be shifted,

and

20 commanding a repositioning and display of the graphical elements of
said selected subgraph by calling the one or more first methods
implemented by the second subgraph class of which said selected
subgraph is an instance;

25 such that when an instance of a second layout manager class is created, said one or
more second methods are executed, whereby layout manager represented by that
instance identifies a plurality of subgraphs in said graph and initiates the repositioning
and display of the graphical elements of a plurality of subgraphs in said graph by
commanding the repositioning and display of the graphical elements of a selected
30 subgraph in said graph.

44. A method of displaying a constrained graph, said graph constructed using a
plurality of graphical elements, wherein a first subgraph class is defined that can be
extended to define a plurality of second subgraph classes, wherein an instance of each
35 of said second subgraph classes represents a subgraph of a specific subgraph type,

5 wherein each subgraph of a specific subgraph type is composed of a predefined grouping of one or more of said graphical elements, and wherein each of said plurality of second subgraph classes implements one or more first methods for repositioning the graphical elements of a subgraph represented by an instance thereof within said graph and determining affected subgraphs, displaying the graphical elements of a subgraph
10 represented by an instance thereof to said user in a specified layout format, and commanding a repositioning and display of the graphical elements of said affected subgraphs, said method comprising:

identifying a plurality of subgraphs in said graph;
15 receiving an identifier of an input subgraph in said graph;
determining from said identifier a selected subgraph to be shifted; and
commanding a repositioning and display of the graphical elements of said selected subgraph by calling the one or more first methods implemented by the second subgraph class of which said selected subgraph is an instance;

20 whereby a plurality of subgraphs in said graph are identified, and the repositioning and display of the graphical elements of a plurality of subgraphs in said graph is initiated by commanding the repositioning and display of the graphical elements of a selected subgraph in said graph.

25 45. The method as claimed in claim 44, wherein said first subgraph class is an abstract class.

30 46. The method as claimed in claim 44, wherein the selected subgraph determined from said identifier is said input subgraph.

35 47. The method as claimed in claim 44, wherein said steps of said method are performed when one or more user-specified graphical elements are added to or deleted from said graph.

5 48. The method as claimed in claim 44, wherein data associated with subgraphs identified is stored in a map, and wherein said map is used by instances of said second subgraph classes in determining affected subgraphs.

10 49. A method of displaying a constrained graph, said graph comprising a plurality of graphical elements and a plurality of subgraphs, wherein each of said plurality of subgraphs comprises a grouping of one or more of said graphical elements, said method comprising:

15 determining from an identifier of an input subgraph in said graph, a selected subgraph to be repositioned; and

repositioning the graphical elements of said selected subgraph.

20 50. A method of displaying a constrained graph, said graph comprising a plurality of graphical elements and a plurality of subgraphs, wherein each of said plurality of subgraphs comprises a grouping of one or more of said graphical elements, said method comprising:

25 repositioning the graphical elements of a subgraph within said graph; and

initiate a repositioning of the graphical elements of subgraphs affected by said repositioning of the graphical elements of said subgraph.

30 51. The method of claim 50, wherein each of said plurality of subgraphs is adapted to display the graphical elements of a subgraph in a specified layout format.

52. The method of claim 50, further comprising:

5 initiating the repositioning and display of the graphical elements of a plurality of subgraphs in said graph by commanding the repositioning and display of the graphical elements of a selected subgraph in said graph.

53. The method of claim 52 further comprising:

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identifying a plurality of subgraphs in said graph;

receiving an identifier of an input subgraph in said graph;

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determining from said identifier a selected subgraph to be shifted; and

commanding said selected subgraph to reposition and display the graphical elements.

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